



Influence of *Varroa* parasitization on some biomolecules in *Apis mellifera* L. worker brood

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Abstract

The present study includes investigation on biochemical parameters i.e. total protein, glucose, glycogen and cholesterol content in *Varroa* infested and non infested worker brood of *Apis mellifera* L. *A. mellifera* worker pupa (brown eyed stage) was taken from the colonies maintained by Department of Zoology, Panjab University, Chandigarh. *Varroa* infested worker pupae of *A. mellifera* showed a decline in glucose and glycogen content as compared to the uninfested control. This is suggestive of greater utilization of body energy reserves as a result of parasitic stress. Fall in the level of cholesterol in the infested pupae observed during the present study was probably due to its incidental intake alongwith proteins while feeding on the haemolymph.

Keywords: *Varroa*, *Apis mellifera*, protein, glucose, glycogen, cholesterol.

Introduction

A honey bee colony is vulnerable to predator and parasite attack because it provides rich and concentrated food sources in the form of brood, wax, honey and pollen. Therefore honey bee colonies often fall prey to various enemies including large hairy mammals like bear, badger, martens and tiny parasites including protozoans and mites. The mite, *Varroa destructor* (Anderson and Trueman, 2000) is a major pest of honey bees in most parts of the world. This external parasite feeds on haemolymph (blood) of adult bees, larvae and pupae. Heavy parasitism results in high bee mortality and subsequent weakening of the colony which leads to colony death. The mite was originally found parasitizing the Indian honey bee, *Apis cerana* (Oudemans, 1904), but with time the mite extended its host range to *A. mellifera*. On *A. mellifera* it parasitizes worker brood as well as drone brood and thus has become a serious mortality factor. Honey bee parasitization by *Varroa* is capable of eliciting biological, behavioural, morphological and physiological pathogenesis. The present investigation was conducted to understand physiological interference due to mite infestation through biochemical assays.

Materials and Methods

Study Area and Material: A random sample of *Varroa*

destructor infested (harbouring two mites) and non infested worker pupae (brown eye stage) of *A. mellifera* were drawn from the infested and healthy colonies maintained by Department of Zoology, Panjab University, Chandigarh.

Sample preparation: Each pupa was taken in 1 ml of saline and electrically homogenized. The homogenate was used for further experiments.

Biochemical estimation: The quantitative estimation of total protein, glucose, glycogen and cholesterol was done following standard methods (Sawhney and Singh, 2000). OD's were taken on colorimeter. Each estimation was repeated three times with three replicates per estimation.

Results

The consequences of parasitisation by *Varroa* on biochemical parameters in infested worker brood of the European honey bee *A. mellifera* were examined and compared with healthy worker brood. Results are presented Table 1.

Discussion

Varroa mother mite produces wounds on the host cuticle with its saw toothed chelicerae during feeding (Martin, 1997). The development of the infested worker

Table-1: Protein, Carbohydrate and Lipid content of non-infested and *Varroa* infested *Apis mellifera* L. worker pupa.

S.No.	Biomolecules	Non- Infested (mg/ml) Mean \pm S.D.	Infested (mg/ml) Mean \pm S.D.
1.	Protein	0.279 \pm 0.002	0.194 \pm 0.001
2.	Glucose	0.411 \pm 0.003	0.399 \pm 0.003
3.	Glycogen	0.027 \pm 0.002	0.010 \pm 0.002
4.	Cholesterol	0.122 \pm 0.003	0.049 \pm 0.005

brood is impaired leading to the formation of malformed adults. The infested adult worker bees have been reported to exhibit reduction in haemolymph volume (Weinberg and Madel, 1985). Bowen-Walker and Gunn (2001) studied the biochemical effects of *Varroa* parasitisation on adult worker *A. mellifera*. According to them, wet weight, dry weight and water contents of emerging worker infested with the mite were all negatively correlated with increasing numbers of mites. Parasitized bees also emerged with lower head and abdomen concentration of proteins. Sugars are known to be important energy source, small amounts of glycogen, glucose, fructose and trehalose serve as essential energy material in foragers (Leta *et al.*, 1996; Panzenbock and Crailshein, 1997; Blatt and Roces, 2001, 2002; Woodring *et al.*, 2003). Decline in carbohydrates content during the present studies is suggestive of greater utilization of body energy reserves as a results parasitic stress.

Lipid levels in *Varroa* infested adult worker were studied by Bowen-Walker and Gunn (2001). However they did not observe any detectable change in the levels of this molecule because lipid levels are naturally extremely low in adult bees at emergence as compared to brood (20-30%) (Hepburn *et al.*, 1979). Reduced cholesterol content observed during the present study can be explained on the basis of the fact that selective uptake of haemolymph devoid of fats is not possible. Hence some amount of cholesterol is also lost due to feeding on the larva. It can therefore safely be concluded that parasitisation by *Varroa* on worker brood causes significant losses of metabolic reserves leading to weakened individuals often unable to open the caps to emerge as also observed by Boecking and Drescher (1992).

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